very greatly magnified. They vary somewhat in size, and the orange-colored ones are most numerous in the specimen before me. There is a cloudiness in these yellow globules and a few are not completely spherical, presenting a cup-shaped form. To the naked eye the green globules appear to be black, but under the microscope they are evidently dark green. The composition of the two sets are no doubt the same, and the color probably depends on their being in a different state of oxidation. In a few cases I observed the two colors in the same globule. In another specimen from the same locality I found the globules to be much smaller and the green ones to prevail.*

Fig. 13. An *Asteriated Sapphire*, also belonging to Dr. Le Conte, of an obtuse conical form, and of unusual beauty, presented very remarkable microscopic crystals of a white silken hue. The larger of two sets were generally, though not always, cuneate and lay in three directions, differing somewhat in size. In the smaller set the crystals are very minute, having the same pure white, silken appearance. These fill up the interstices of the larger crystals.

A Sapphire of large size and peculiar beauty, in the possession of Dr. Le Conte, presented a few distant, white silk-like lines, running in one direction, and parallel to each other. It is of unusual brilliancy and fine color and is thirteen-twentieths by eleven-twentieths of an inch in size.

Fig. 14. A *Pyrope* from New Mexico, in which the microscopic crystals differ from any of the many *Garnets* I have examined. In other specimens from this locality—of which I have examined twenty in the collections of Prof. Frazer and Dr. Le Conte—acicular crystals alone were found. In this specimen the crystals are much larger, less in number and of an entirely different character. Some are geniculate and transparent, while some are dark or semi-transparent. A very short and rather thick crystal seems to present three sides of an hexagonal prism. These New Mexican *Pyropes* are of uncommon beauty and perfection. This specimen is in the collection of Prof. Frazer. His other seven specimens have acicular crystals. Of Dr. Le Conte's twelve specimens, six had acicular crystals, and six presented no appearance of inclusions. When the acicular crystals are examined in the direct rays of the sun at right angles to their axis, they reflect all the spectral colors in a very beautiful manner.

A small brilliant *Ruby*, which has the appearance of being oriental, but which may be a *Spinel Ruby*, was found to be very full of long acicular crystals which were observed to be in all directions, and were to all appearances the same as observed in *Precious Garnets*. A larger specimen has the same kind of acicular crystals, but in this specimen these crystals take generally two directions and are oblique to each other.

Two out of four other very beautiful small *Oriental Rubies* = *Sapphire* were found to have very minute acicular crystals. In one of them these crystals were in three directions; in the other they were in two directions. Both these gave that peculiar changable band observed in the "Catseye" Sapphires. All these rubies were cut as brilliants and were of great beauty.

It is apparent that the microscopic crystals in the various minerals above described, cannot all be of the same substance. Their forms and appearance forbid that, and chemical analysis will never probably reach, with any degree of satisfaction, their ultimate constituents. Spectral analysis may, however, be able to give us some results when properly applied, which may in some measure satisfy us in regard to the composition of these interesting included microscopic crystals.

Sexual Law in the CONIFERÆ.

BY THOMAS MEEHAN.

In some various papers last year before this and other bodies, I was able to prove, I believe, to the satisfaction of my fellow botanists, that the true leaves

* The Amethysts of Chester County, Penna., very frequently have minute acicular crystals of *Rutile*.

of Conifera are mostly adherent to the branches, and that the *degree of adhesion is in exact proportion to specific or individual vigor.* I believe I can now show that the production of the sexes is influenced by the same law,—that a high stage of vitality, or vigor, is favorable to the production of female flowers; and a low stage, or comparative weakness, to the production of male ones.

Every one must have noticed that the cones of these trees are always on the strong vigorous branches towards the top of the tree, or on the ends of the strong laterals. Only this year did I observe that the male flowers are never on these strong branches, seldom near the ends of the main shoots, but down amongst the lowermost and weakest branches, and in the more interior parts of the trees.

My observations have been confined to *Pinus* and *Thuja*. I have examined many hundreds of trees; and so clearly does this law universally prevail, that I am certain I have but to point it out in order to obtain a ready assent to it.

The effects of vigor in bringing about these different sexual relations are very interesting. Taking the Scotch, Austrian and Table Mountain Pines, which I have had daily before me, the young shoot commences its axial growth early in spring. Its base is the weakest part of it, being partially formed late in the previous season, when vitality was about to take its annual rest. Therefore, according to the laws of adnation or cohesion which I have before indicated, there are no branches, but the leaves are mostly free, taking the form of long chaffy scales. As the shoot grows it gathers strength, the leaves become more and more adnate with the stem, and after a few inches of such growth the branchlets in the shape of phylloid shoots or fascicles of "pine needles" appear. These gather strength as the shoot progresses, as shown by their increasing length, until if the axis or shoot is very strong, a female cone appears. The whole process exhibits a regularly increasing vigor, during which the leaves are first suppressed, and ultimately both leaves, stem, and axis with the culmination of vigor are suppressed or metamorphosed into a female cone.

Turning again to another and weaker branch, pushing forth into spring growth, we find the base, instead of being bare of all except the free leaf scales, has little conical heads of male flowers pushing from the axils of the leaf scales, and which, if higher up, and when the shoot has attained more vigor, would be phylloid fascicles. These male heads of flowers are evidently metamorphosed branch fascicles, the first transformation of which commenced the year previous when active vitality was about to cease. It might occur here to inquire why lingering vitality would not produce in the fall rudimentary changes of the embryo fascicles at the base of the strong and ultimately cone-bearing shoots, as well as the weaker ones? This must be left to future examinations. Possibly, to hazard a guess, strong shoots may have the power of more rapidly maturing in the fall than the other ones.

Another very interesting fact in connection with this subject is the loss of power to branch, which the formation of male flowers induces. Taking a branch of a Scotch Pine, if it lay not the foundation of a series of male flowers in the fall, it will provide at least three smaller buds around one stronger and central one, from which to make its axial growth next season. But if these rudimentary male flowers are formed, no side buds appear; very seldom at least do we find one weak spike along side the main and stronger one.

What that force is which I have called vigor, or by what laws it is governed, I do not pretend to say. I know it only by its effects. In the one case I see a strong axial growth, associated with strong vigorous branchlets, and suppressed foliage, culminating in the formation of female flowers; on the other hand I see a more weak axial development, associated with fewer cotemporary axes, weaker branchlets and greater freedom of the foliage from cohesion, and together with this the production of male flowers. The law is apparent; the nature of the law must be left to further explorers.

[May,